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ABSTRACT

This paper attempts to summarize briefly the history of the Denison University project for learning through simulation, detailing the range of research, development, education and training, and evaluational efforts which resulted in the establishment of the Denisor Simulation Center. The paper includes an explanation of the services currently provided by the Center, and discusses proposals now under consideration to insure its continued operation. A list of the faculty papers and publications available from the Center is contained in the appendix. (Author)

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THE DENISON SIMULATION CENTER: A RESULT OF THREE YEARS OF RESEARCH ON SIMULATION

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

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Abstract

To date several reports have been published on the work in simulation at Denison University. This paper attempts to summarize briefly the history of Denison's project for learning through simulation, detailing the range of research, development, education and training, and evaluational efforts which resulted in the establishment of the Denison Simulation Center. The paper includes an explanation of the services currently provided by the Center and discusses proposals now under consideration to insure its continued operation. A list of the faculty papers and publications available from the Denison Simulation Center is contained in the appendix.

The history of the Denison Simulation Center has been told before in more detail than can be achieved in this presentation. However, perhaps a brief overview would be helpful before going on to describe some of the new projects on which we are now working.

Stimulated by three years of thinking, organization and writing, the Denison Simulation Center began in the fall of 1974 under the sponsorship of a three-year grant from the Lilly Endowment, Inc. Building upon a core of interest in simulation as a teaching and research aid, the Center, during the first year, helped 38 Denison faculty become involved in the use of simulation, sent 20 faculty to conferences and brought seven nationally-known consultants to campus. Funding opportunities led to three release-time projects, eleven research projects, ten professional papers and three papers published in professional journals, as well as a series of on-campus single-issue workshops and numerous classroom changes.

The second year of the Project not only built upon the successes of the first, but also directly attacked the difficult task of evaluation. With the help of an outside consultant, several evaluation measurements were developed, many faculty evaluations reports were written and evaluation began to be accepted as a normative aspect of the Project. The number of simulation-related projects increased: three courses were developed and such interdisciplinary projects as Women's Studies made use of simulation. Also of significance was the increase in the dissemination of the work and ideas produced by the Project. Such dissemination was accomplished in several ways. A variety of major simulation projects were directed at other institutions and catalogs of the Center's activities and holdings were sent to more than 700 such institutions. On campus, the Center sponsored five single-topic workshops and conducted a major summer simulation workshop in June, 1976, in which 24 Denison faculty and 15 outside consultants participated, and 88 persons from 36 colleges and universities attended

and took part in 10 single-area modules and several general simulation sessions. In addition to these activities, Denison faculty also worked within their professional fields, delivering eight papers at professional meetings during the course of the year.

In its third year, the Denison Simulation Center expanded considerably its facilities and capacities. With over 700 simulations, many developed or modified by Denison faculty, evaluation has become more sophisticated, and a major paper on the subject was one of the products of the year. A simulation newsletter was begun to keep the local community abreast of events and developments on a continuing basis, with news items chosen by Student Fellows selected by the Simulation Advisory Committee. In addition, these Student Fellows helped to run simulations, performed simulation research and, in three cases, produced papers read at professional meetings. Denison faculty developed new courses on ethics, environmental affairs, urban studies, and analysis of the future, all of which extensively used simulations. Thirty new papers were presented during the year, of which ten were published. The year culminated in a second summer simulation workshop involving 22 Denison faculty and 62 participants from thirty schools. Modules at this workshop ranged from small group dynamics to history and international relations to computerized biology simulations.

In addition to its continuing services of providing the Denison community and other close constituents such as the Great Lakes Colleges Association with and up-to-date set of simulation materials from around the country, the Denison Simulation Center has now undertaken a series of projects related to many of the directions begun under Lilly auspices. Let me describe some of them for you.

As was noted above, evaluation, not simply of individual simulations, but of the process and technique of simulation itself, was a critical component of the project from the second year on. In fact, the success achieved in developing significant methods of evaluation of simulation is one of the things which make

the Denison project as valuable as it was. For we have found that our faculty and others with whom we have shared some of the evaluational results of our studies have become not only more adept at the use of simulation, but also more conscious of the need to evaluate all of their activities in the classroom and to subject their teaching to regular and systematic scrutiny to make sure that they are in fact achieving those ends which they intend. Accordingly, we have continued to emphasize the evaluational issue and have formed a special interest group of Denison faculty who have taken it upon themselves to develop a systematic study of evaluation as it can be applied across the board to the process of undergraduate education.

The results of this study are for the future, however. For the present, I would like to present briefly some of the results of the evaluational studies of simulation which we have been able to make in the last several years.

Effective evaluation is not something which can be undertaken, whether in simulation or any other field, only after the completion of a project. It must be a part of the project from the start. Therefore, it is of critical import that an evaluator know his goals before undertaking a simulation. In fact, we would argue that the clearer an instructor is about the goals of <u>all</u> his teaching, the more effective he will be in communicating to his students and the more he will be able to change his methodology to meet deficiencies which may arise along along the way. Flexibility and the faculty of healthy self-criticism are essential, therefore, to good evaluation.

Once the goals of a simulation exercise are defined, one must move to a consideration of the constraints in particular evaluational designs. We have tried a variety of methods at Denison, testing not only the simulations, but also the processes of evaluation to determine which gave use the best information about the simulation which we could effectively use to improve the games in the future.

Let me illustrate. We determined that there were essentially four different goal areas in which teachers were interested. That is, four general questions arose concerning the function of simulation: 1) how can we use simulation to make the students more interested in the class, to turn what could be boring material into exciting subject-matter? 2) how can we change or affect student attitudes or values regarding some of the ideas or issues addressed by the course in question? 3) how can we convey information more effectively to the students and help them understand complex interrelationships among the elements discussed in the course? 4) how can we help the students to apply complex theory to new problems; how can we help them to transfer knowledge from a known situation to an unknown set of circumstances?

Once we had established the categories of questions in which instructors were interested we were better able to design evaluations which tried to answer these questions and to measure the simulations we used in light of the goals we had set for ourselves. Clearly, a simulation which did well in answering one question need not be effective in answering others. One's standards of measurement must be clear.

We then moved on to look at various alternative methods of evaluation. We looked at the following methods: 1) treatment-posttest; 2) pre-test--treatment--posttest; 3) use of control groups, some of whom received a different treatment (i.e., not simulation) and some of whom received no treatment whatsoever; 4) use of questionnaires; 5) use of outside observation and evaluation; 6) measurement of various quantifiable tangential factors (e.g., amount of time spent by students staying after class discussing material, outside the class, number of students visiting professor to discuss material); 7) interviews with students or with observors of the simulation. We found that all of these methods were of use to the evaluation process and that no single method was judged so superior as to exclude the others. The critical factor was not the method used but the questions asked, the suitability of the method to the goals of the simulation

and the evaluator's ability to take into account the possible biases in the responses. We found we had to separate variables like the student response to the instructor or to the subject matter from the response to the simulation; we had to watch for self-selection among students if we allowed them to choose a simulation-oriented section of a course which we would then measure against a non-simulation section. And, perhaps most importantly, we found that the effectiveness of simulations depended in large part on how well it was integrated into the course in question. One could not, therefore, separate a simulation from the context in which the students confronted it. A simulation viewed by instructors and students as part of the on-going curriculum, as tied to external motivations (like grades or forced student evaluations) and as a critical component of the course was likely to be considerably more successful in achieving its goal than one which was perceived as "stuck in" at the last minute or as a tangent from the "normal" direction of the course.

Let me move now to some general conclusions we have reached regarding evaluation. First, we found that students do tend to like simulations. This is nothing new, however, and something which most people familiar with simulations have noted empirically.

Second, we found that simulations, if well conceived, tended to result in better student empathy with value structures other than their own. They understood better what it was like to live in a non-American social structure, to have to make decisions based upon a different set of values or to confront some of the ethical dilemmas with which persons in circumstances other than their own are faced.

Third, we found that simulations so not necessarily convey information better. In fact, given the amount of time and energy necessary to make a simulation work, less information may be conveyed than could be imparted via another methodology such as lectures or self-paced learning. Simulations may, however, provide incentives to students to internalize the information better and for a longer period

of time. It would be useful, although we have not yet had the opportunity to carry this through, to measure information retention by students after a ten year hiatus to see whether our intuitive sense is correct and simulation does indeed produce long-range ability to recall and use information.

Fourth, while simulations do not bring greater information to the student, they do help to convey relations better. Students seem better able to solve problems, especially at the elementary level, than they are without the aid of simulations. Our data indicates that simulation is most effective in this respect for the average or below average student. The superior student tends to solve problems equally well with or without the aid of simulation. Preliminary findings indicate that the ability to generalize from one problem to another is likewise effected by simulation in the same way, but we have not yet developed more conclusive studies to demonstrate this result with certainty.

Finally, we should note that simulation is not and can never be a cure-all to the problem of educational methodology. More and more we have become aware of differences in cognitive styles among students, and simulation can at best meet the needs of only some of our constituents. We must as teachers, therefore, always be on the look-out for effective ways to communicate with a variety of methodologies, of which simulation is only one option. That caveat accepted, however, we believe that our efforts with simulation evaluation have taken us a long way towards a better understanding of the process of making simulation a technique which can achieve positive results within the limitations inherent in any single teaching methodology.

Our work with evaluation has taken the Denison Simulation Center into a more general inquiry also into problem-solving as a foundation of educational theory. Another special interest group has undertaken the task of writing a detailed proposal whereby the Denison faculty will, over the next five years, examine problem-solving as a focus of teaching, using a variety of techniques,

including simulation. We are hoping for outside funding for this project.

A third special interest group has likewise grown from the interest engendered by the simulation project at Denison, this one concerned with values and value issues. For some time, a large block of Denison faculty have wondered how we would better address the issue of values without becoming dogmatic or rigid in our methodology or approach. It was our desire to confront students with ethical issues, to force them to deal with value questions and to prepare them better for meeting the ethical dilemmas with which many of them will be confronted in their professions or their lives after Denison. Having experimented with simulation as a technique for achieving these goals and stimulated by a desire to examine more closely the programatic impact of values education upon the college as a whole, representatives of the simulation project have combined forces with members of the community not involved with the Center whose interest and expertise in ethics has lead them to similar concerns. Our efforts have results in a major proposal for curricular revision and for further outside funding for the entire university.

In these various ways, we find that the work and impact of the Denison Simulation Center extends far beyond the scope of simulation as a teaching technique. We are engaged in the on-going life of the university and we see simulation, therefore, as a stimulus to a general active confrontation of ourselves as teachers and educators.

The Center has not only become in these various ways an integral part of the Denison community. It has increasingly worked to disseminate the results of its work to other campuses. Let me cite four examples of these efforts.

For five days during the second week of June, 1977, the Denison Simulation Center hosted its second major summer workshop, attended by 62 participants from thirty colleges and universities across the country. Staffed by 22 Denison faculty, the workshop offered six modules on specific applications of simulation

skills and techniques which could be applied in a liberal arts environment. The focus of these modules ranged from biology, computer and chemistry to psychology, social science and small group dynamics. Modules met every morning and afternoon and were aimed at the production of simulation materials, such as games, evaluational techniques, computer programs or models, any of which could then be taken back to the home institution for use and further development and modification.

The workshop also provided an opportunity for participants to gain a greater understanding of the variety of options within the field of simulation and to develop a familiarity with the philosophy behind simulation techniques. Accordingly, the program also involved general sessions and seminars on the running of games, group dynamics exercises, evaluation of teaching effectiveness of simulation, model design, simulation and values clarification and problems of computerizing simulations. Finally, the workshop provided opportunities for Denison faculty and participants to play a variety of games and to discuss informally the particular questions which may have arisen during the more formal part of the program.

Preliminary evaluation of the workshop indicates that it satisfied well the objectives laid out for it. Faculty left the experience with a greater sense of the potential of simulation as a teaching aid and of the variety of possibilities which it presented. They left with a sense of their own competence as simulation leaders and designers, and some of the participants have since indicated that they have tried simulation in their own programs. A more formal inquiry following up on the use of the skills and information acquired in the workshop will be conducted in the spring of 1978. It seems clear, however, at this point that the workshop responded to need, provided stimulation to those who took part in it, both at Denison and elsewhere, and helped to promote the active dissemination of the developments fostered at Denison by the Simulation

Project. The experience of this workshop, as with its predecessor in 1976, was extremely exciting for all. As with so many innovative techniques in teaching, so the use of simulation becomes most engaging when one shares with others the problems and the successes associated with it. It is in communication that effective teaching grows, and this summer's workshop was at its heart an experience in communication. Therein lies its value and on that basis can be termed a success.

Second, we are now in a position to be able to offer both the over 120 papers and articles written by Denison faculty on simulation and the newly completed computerized catalogue of simulations to the general public. A partial listing of these publications and papers is available at the end of this paper or in our brochure. The catalogue lists not only the approximately 700 commercially available simulations in 29 subject categories but also 25 simulations developed and tested by Denison faculty. It is kept up to date with the addition of new materials as they become available and the deletion of out of date or ineffective materials. We anticipate this catalogue will be an ongoing resource for wide use.

Third, we are now awaiting the publication of a series of papers written by participants in the two Denison Simulation Workshops. This should be out of press by next summer to make available to a wider audience in a single volume examples of the variety of work undertaken over the past four years at the Center.

Finally, we have begun to serve as a consulting referral service. With over twenty faculty members who have expertise in a wide range of simulation activities, the Center keeps a complete listing of available personnel and will act as a clearinghouse for institutions interested in specific consulting problems. Already we have begun to work in this capacity, leading symposia not only for the Great Lakes Colleges Association but also directing a four-day

workshop this spring for the Kansas City Regional Council for Higher Education. We have been encouraged by the response we have received so far to this additional service and we hope that in the future the consulting referral service provided by the Center will be able to disseminate the positive results of our work to a still wider audience.

The Denison Simulation Center is, therefore, an expanding institution. But its expansion must be within the context of the educational framework of the liberal arts college. Its work has all been geared to provide direct impact on the educational process and the functions in which its members are now engaged, whether they be evaluation, problem-solving, value consideration, or dissemination of information and expertise, all have as their ultimate goal the improvement of the quality of education and increased facility of communication between student and teacher in this country.

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